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FOREST PEST MANAGEMENT

United States
Department of
Agriculture

Forest
Service

Northern
Region

State &
Private
Forestry

USERS GUIDE AND DOCUMENTATION FOR INSECT AND DISEASE DAMAGE SURVEY (INDIDS)

Report No. 85-19

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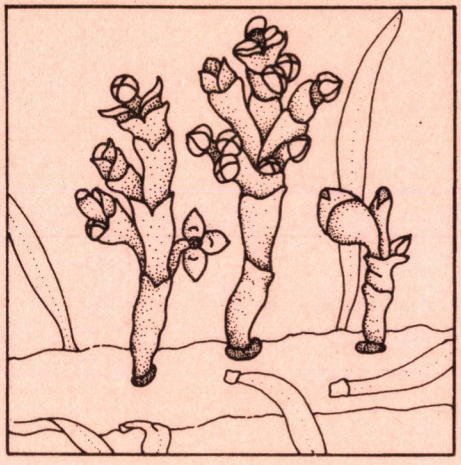
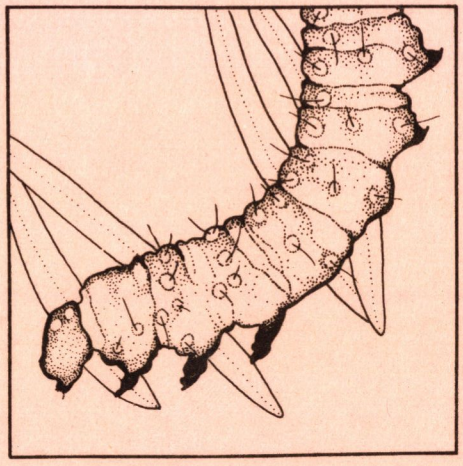
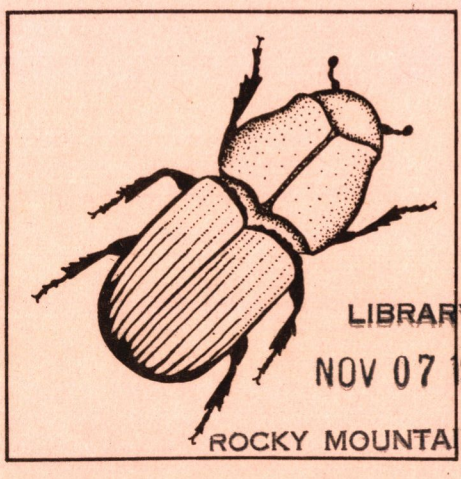
Wayne Bousfield, Robert Eder, and Dayle Bennett







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USERS' GUIDE AND DOCUMENTATION FOR INSECT AND DISEASE DAMAGE SURVEY (INDIDS)

Wayne Bousfield, Robert Eder, and Dayle Bennett[1]

INTRODUCTION

Forest entomologists and pathologists are often confronted with the assessment of damage caused by insects and diseases or a combination of the two. Land managers can best use the information when damage assessments are sampled and compiled on a per acre basis for a stand. Timber Management personnel collect damage information while doing stand examinations, but not always in the detail necessary, resulting in incomplete display tables. INDIDS is a computer program that will compile stand information. Data is presented in detailed tables relating to insect and disease problems. Manuals explaining how to collect the data are available (Bousfield 1979; Bennett, et al. 1983). Stand examination data in Region 1 can also be processed by INDIDS but some resolution is lost in damage code conversions.

Two versions of INDIDS are available. One is for the Northern Rocky Mountain area and the other for the Southwest area. Two were required because of different species, volume equations, growth rates, and insect and disease problems. Currently, six output options will display various groups of pest problems. The type of display output is controlled in the header card. Different options can be run on the same data set by changing the survey type. Different output options are (1) Bark Beetles, (2) Defoliators, (3) Diseases, (4) Miscellaneous Insect and Damaging Problems, (5) Combination of Bark Beetles and Root Disease, and (6) R-4 Disease Option. Not all of these options are available in each version. Examples of stand summary tables for the various options are shown in Appendix 1. INDIDS has the capacity to identify up to three insect or disease problems for each sample tree. Trees are sampled in the same manner as when conducting a stand examination; however, not all of the same sample attributes are collected for INDIDS surveys.

EDIT CHECKS

An edit program (EDINDS) will check for some errors in data collection or recording. The program will check for valid survey type, habitat type, (Northern Rocky Mountain only), tree species, suspicious height (tree height greater than 150 ft.) suspicious d.b.h./height ratio (not between .25 and 1), no d.b.h. recorded, number of plots counted compared to number recorded, number of green tree plots greater than total plots, valid damage code, suspicious number of trees (Southwest area only) and invalid forest number (Southwest area only). An example of a data file for the Northern Rocky Mountain version is shown in Appendix 2.

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SAMPLED TREE ATTRIBUTES

Since tree height and radial growth are collected on a subsample, this data must be filled in the tree list before calculations are initiated by INDIDS. Regression estimators are used to calculate values for unmeasured data. Transformation on diameter (1/d.b.h. +1) and height (ln(HGT-4.5)) are accomplished before entering into a regression subroutine (LINREG). The following equation will predict heights:

$$HGT = EXP[A+B \ / \ (d.b.h. + 1)] + 4.5$$

Coefficients for A and B are calculated by LINREG for each tree based on the measured tree heights and diameters. Current versions are not species specific. Similar calculations are accomplished to estimate 10-year radial growth not measured; however, no transformations are done. The following equation will calculate radial growth measurements for trees not sampled for growth:

$$\text{Radial Growth} = A + B * d.b.h.$$

Coefficients for A and B are calculated by LINREG for each stand.

PLOT DESIGN AND MENSURATIONAL MEASUREMENTS

INDIDS has the capacity to expand data collected by either variable or fixed plot design. This includes "strip plots" which are actually rectangular fixed plots of specific size. INDIDS provides the opportunity when sampling bark beetles to record "attacked trees" on all plots but record live tree information on a lesser number of "green tree plots." For proper execution the program requires the number of both "green tree" and "total plots" sampled, and the type of plot design. Expansion is based on the damage code used. Trees with a 0 code will use the "green tree" number of plots, and other codes will use "total plots" sampled. This sampling technique will decrease the sampling error of attacked trees, but increase sampling error on the "green" stand for the same amount of time expended collecting data.

The trees per acre (TA) and the basal area (BA) represented by each sample tree recorded on the plot are calculated as follows:

1. For trees greater than 5" d.b.h.

   A. Variable Plot Design

   $$TA = (BAF \ / \ (d.b.h.^2 * .005454)) \ / \ \text{Number of plots}$$

   $$BA = BAF * \text{TREE TALLY} \ / \ \text{NUMBER OF PLOTS}$$

   Where .005454 = Multiplier to convert $d.b.h.^2$ in inches to square feet of area.

   BAF = Basal area factor.

B. Fixed Plot Design

TA = SIZE / NUMBER OF PLOTS

BA = (d.b.h.^{2} * .005054) / NUMBER OF PLOTS

Where SIZE equals the denominator of the plot area (fraction of an acre).

2. For trees less than 5" d.b.h. (both variable and fixed plot design):

Since INDIDS assumes that all trees less than 5" d.b.h. are sampled only if they fall within 6.8 feet of plot center (1/300 acre) there is only one equation for trees per acre calculation.

TA = 300 / NUMBER OF PLOTS

BA = d.b.h.^{2} * .005454 * TA

VOLUME COMPUTATIONS

Volume computations use Kemp (1956) for the Northern Rocky Mountain version and Hann and Bare (1978) for the Southwest version. Modifications for ponderosa pine volume equations are planned for the Southwest version to conform to Region 3 standards.

Tree Volume Calclualtions (Northern Rocky Mountain)

1. Cubic foot volume (CFV) is calculated using the following equations for three diameter classes:

Diameter class	Equation
5"-9.9"	$CFV = X * (b_1 * d.b.h. + b_2 * d.b.h.^2 + b_3 * d.b.h.^3 + a_1)$
10"-20.9"	$CFV = X * b_4 + a_2$
21" +	$CFV + X * b_5 + a_3$

Where $X = d.b.h.^2 * HGT / 100$ a_i and b_i are species specific by size class.

2. Scribner board foot volume (BFV) is calculated for the following diameter. There are two diameter class equations for board foot volume calculations.

Diameter class	Equation
7" - 20.9"	$BFV = b_1 * d.b.h.^2 * HGT / 100 + a_1$
21." +	$BFV = b_2 * d.b.h.^2 * HGT / 100 + a_2$

Where a_i and b_i are species specific by size class.

Tree volume calculations (Southwest version)

1. Cubic foot volume (CFV) equation:

   $CFV = a_i + b_i * d.b.h.^2 * HGT$

   Where a_i and b_i are species specific by forest location.

2. Board foot volume:

Scribner board foot volumes are derived in a series of steps. First the CFV is calculated as:

a. $CFV = a_i + b_i * d.b.h.^2 * HGT$

merchantable CFV (MCFV) is then calculated as:

b. $MCFV = CFV - b_o + b_1 * (TD^3 * HGT / d.b.h.^n) + b_2 * d.b.h.^2$

Where TD = Top diameter = 6" b_i are species-forest coefficients
n = Species and Forest specific power on d.b.h.
Other terms previously defined

Gross International 1/4" board foot volume (GIBFV) is then calculated as:

c. $GIBFV = MCFV * (d_o - d_1 * 1/d.b.h. - (d_2 * 1/d.b.h.^2) - d_3 * 1/d.b.h.^3$

Where d_i are species - Forest coefficients

Scribner board foot volumes (SBFV) are then calculated as:

d. $SBFV = GIBFV * (e_0 - e_1 * 1/d.b.h. - e_2 * 1/d.b.h.^{1.177748} - e_3 * 1/d.b.h.^2)$

Where e_i are species - Forest coefficients

GROWTH COMPUTATIONS (PAI)

Tree growth is of particular interest to entomologists and pathologists because forest pests often reduce potential growth of a stand. A measurement of this reduction is important.

INDIDS will calculate growth of trees (Northern Rocky Mountain version only) when the 10-year radial growth is taken on a sample of the trees. Future development of INDIDS will include a height growth model so that stand growth can be computed for the Southwest version. For the Northern Rocky Mountain version there is a diameter and height growth subroutine, developed by (Stage 1975), that will predict diameters and tree height 1 year hence. Diameter growth calculations are as follows:

$$d.b.h. + 1\ YEAR = SQR\ (d.b.h.^2 + DD * (2 * d.b.h. + DD) * BRK/10)$$

Where DD = 10-year past diameter growth (2 * radial growth)
BRK= Species specific bark ratio
d.b.h. + 1 YEAR = Predicted diameter 1 year hence

Height growth is calculated as follows:

$$HGT + 1 = HGT + EXP\ (\ ASPE + AHAB + BHAB * ALOG(DD + .05) + CHAB * ALOG(d.b.h.) + DSP * ALOG(HGT))\ * .11066$$

Where HGT + 1 = height 1 year hence
ASPE = Species intercept coefficient
AHAB = Habitat intercept coefficient
BHAB = Habitat specific coefficient for d.b.h. growth
CHAB = Habitat specific coefficient for DHB
DSP = Coefficient for height (HGT)

Periodic annual increment (PAI) is computed by calculating the difference in cubic foot volume for 1 year's growth and expanding it by the trees per acre it represents.

INDIDS has the capacity to test basal area increment (BAI) for effects of defoliation by covariance analysis. This technique can only be used when:

1. Defoliation effects are quite periodic in an area and the current outbreak is 10 years or less.

2. Normal growth period exists prior to some current outbreak.

3. Nonhost pines are distributed throughout the stand. The instruction manual explains how to collect the data. The normal BAI prior to known infestation history (x) is the covariant and the BAI during the known infestation history becomes the (y) variable. BAI is computed as follows:

$$DIB = d.b.h. * 1/1.09$$

$$YBAI = [3.14 * DIB^2 / 4] - [3.14 * (DIB - 2 * YGROW)^2 /4]$$

$$XBAI = [3.14 * (DIB - 2 * YGROW)^2 / 4] - [[DIB - (YGROW + XGROW) * 2)]^2 * 3.14 / 4]$$

Where DIB = Diameter inside bark.
1.09 = Bark ratio for all species.
YBAI = Basal area increment during the period of infestation.
XBAI = Basal area increment during a time period of normal growth before the infestation.
YGROW = Radial growth measurement during the period of infestation.
XGROW = Radial growth measurement during a time period before the infestation.

Only the trees measured for growth are used in the covariance analysis. If the "F" test is greater than 3.0, the percent of the adjusted BAI means are used to correct the 10-year radial growth measurement. This reflects what growth could have been without defoliation, or expected PAI (EPAI) as compared with actual PAI (APAI). Percent change of YBAI as determined by the covariance test is used to calculate the expected radius. The difference of the two radii, 10 years ago and expected radius, is then used to compute the expected periodic annual increment. The following equations will compute both expected d.b.h. and expected 10-year radial growth for each tree.

EXPECTED DIB RADIUS = SQRT((X-AREA + (YBAI / PERCENT)) / 3.14)

Where X-AREA = Area of stem inside bark before outbreak
YBAI = Basal area increment during outbreak.
PERCENT = Mean YBAI / Covariance adjusted YBAI

EXPECTED 10 YEAR RADIAL GROWTH = EXPECTED DIB RADIUS - DIB RADIUS 10 YEARS AGO

Other terms as previously described above.

The expected diameter (d.b.h.) and 10-year growth is substituted in the growth model to predict EPAI.

If the tree has a top-kill code, no height growth is used for APAI calculations. Trees killed by insects or diseases are not included in APAI calculations.

CROWN COMPETITION FACTOR (CCF)

Stand growth is related to density and competition for crown space. Crown competition factor is a measurement of this density based upon the space occupied by open grown trees. Crown competition factor is the percent of an acre that would be occupied by a stand if all the trees were open grown. The CCF for the stand is computed as follows for the Northern Rocky Mountain version only: (Krajicek et al. 1961) (Wykoff et al. 1982)

There are two equations for CCF computations depending on tree diameter.

1. For trees greater than 10" d.b.h.

   $CCF = b_0 + d.b.h. * b_1 + d.b.h.^2 * b_2$

2. For trees less than 10" d.b.h.

   $CCF = d.b.h. * b_4 \# b_3$

   Where b_i are diameter class - species specific coefficients

Each of the sample trees are then expanded according to their probability of selection (TA) and the CCF accumulated to represent the stand total on a per-acre basis.

SAMPLING ERROR

The percent sampling error (PERSE) for each stand attribute pertaining to insect and disease problems is computed as follows:

$$PERSE = SQR\ [[SUM\ X^2 - (SUM\ (X^2)\ /\ N)\ /\ N\text{-}1]\ /\ N]\ /SUM\ X/N * 100$$

N = Number of plots
X = Plot total for each attribute

A display of the percent sampling error is found on the bottom of the species total page in Appendix 1.

AVERAGE DIAMETER (QMD)

Because insects or diseases often affect a certain size tree, there is need to know the average diameter killed or affected. Trees less than 4.5 feet in height or 0.1 d.b.h. are not included in the computations. This prevents an abnormal dilution of the QMD. The quadratic mean diameter or average diameter is computed for each species, by insect or disease problem, as follows:

$$QMD = 2 * SQR(BA/TA\ /\ 3.14 * 144)$$

An example of QMD is shown in Appendix 3.

MOUNTAIN PINE BEETLE MORTALITY MODEL

A mountain pine beetle mortality model for lodgepole pine (Cole and McGregor 1983) will predict trees per acre expected to be killed during the course of a 10-year outbreak. The model will exhibit beetle-caused mortality in 10 diameter classes ranging from 0 to 19+ inches. Mortality functions are dependent upon diameter and the number of trees per acre in that particular diameter class. The model will display the stand's lodgepole pine component prior to the outbreak in trees per acre, volume by the 10 diameter classes, and mortality in trees per acre during each year of the outbreak by diameter class. It will also display the trees per acre and volume of lodgepole pine after the outbreak. Mortality for each diameter class in terms of trees per acre is calculated as follows:

$$MORT_{t+1} = LIVE\ TA_t * [1 - EXP((\log Q) * MORT_t)]$$

Where $MORT_t$ = Last year's mortality (or default value if none was recorded in the current inventory).

$MORT_{t+1}$ = Predicted mortality 1 year hence

$LIVE\ TA_t$ = Live trees per acre in year t

Q = Variable depending upon diameter class. Q values are 1 for trees less than 5" d.b.h. meaning that none will be killed.

If beetle mortality is in progress when the inventory was conducted, the model assumes it is the first year of the outbreak. Previously killed trees will be subtracted from each diameter class and the current mortality, if any recorded, will be used as $MORT_t$ in the equation. If no mortality is recorded for a particular diameter class, a default value based upon a percentage of the trees per acre will be computed. The model will not grow trees during the 10-year outbreak.

Q value for the 10 diameter classes

Diameter class	Q value
0.0 - 2.9	1.0000
3.0 - 4.9	1.0000
5.0 - 6.9	.9935
7.0 - 8.9	.9830
9.0 - 10.9	.9650
11.0 - 12.9	.9090
13.0 - 14.9	.7430
15.0 - 16.9	.3090
17.0 - 18.9	.2850
19.0 +	.2850

The cubic and board foot volumes per tree by the 10 diameter classes are used to convert lodgepole pine trees per acre to volume. This is computed for each stand.

A display of the mountain pine beetle mortality model is shown in Appendix 4.

PROGRAM EXECUTION

Both versions, Northern Rocky Mountain and Southwest, reside at the Fort Collins Computer Center (FCCC). If stand data is a file at FCCC and in the correct format, it can be run through the program by using the following job control instructions.

Instructions for Northern Rocky Mountain version

To run the edit program-

```
@ASG,A QUALIFIER * FILENAME.
@XQT INDIDS * INDIDS.EDIT
@ADD QUALIFIER * FILENAME.
```

To run the main program-

```
@ASG,A QUALIFIER * FILENAME.
@XQT INDIDS * INDIDS.MAIN
@ADD QUALIFIER * FILENAME.
```

If stand examination data is on a R-1 Edit tape use the following commands and answer all questions. This program will make the damage code conversions, reformatting; and run stream preperations.

```
@XQT INDIDS * INDIDS.RUN-STANDS
```

This process will work only from the Region 1 tapes, and not from other Regions.

Instructions for Soutwest version

To run the edit program-

```
@ASG,A QUALIFIER * FILENAME.
@ASG,A RO3 * INDIDS.
@XQT RO3 * INDIDS.EDIT
@ADD QUALIFIER * FILENAME.
@FREE QUALIFIER * FILENAME.
```

To run the main program-

```
@ASG,A QUALIFIER * FILENAME.
@ASG,A RO3 * INDIDS.
@XQT RO3 * INDIDS.MAIN
@ADD QUALIFIER * FILENAME.
@FREE QUALIFIER * FILENAME.
```

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APPENDIX 1

BARK BEETLE SURVEY
--SPECIES TOTAL--

4/11/85

LOLO 406 02 123 201

DIAMETER CLASS		UNDAM. STAND	CUR. ATTACK	LAST YEAR'S ATTACK	OLDER ATTACK	UNSUC. ATTACK	CUR. STRIP ATTACK	OLDER STRIP ATTACK	CUR. SEC. ATTACK	OLDER SEC. ATTACK	OTHER I+D PROB.	OTHER DAM. AGENTS	OTHER MORT.	STAND TOTAL
	TA	1000.0	.0	.0	.0	.0	.0	.0	.0	.0	100.0	100.0	.0	1200.0
0- 4.9	BA	24.6	.0	.0	.0	.0	.0	.0	.0	.0	5.2	.0	.0	29.9
	TA	213.4	.0	.0	.0	.0	.0	.0	.0	.0	37.0	.0	.0	250.4
	BA	46.7	.0	.0	.0	.0	.0	.0	.0	.0	13.3	.0	.0	60.0
5- 8.9	CFA	982.1	.0	.0	.0	.0	.0	.0	.0	.0	374.0	.0	.0	1356.1
	BFA	3425.7	.0	.0	.0	.0	.0	.0	.0	.0	1261.4	.0	.0	4687.1
	APAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	6.4	.0	.0	43.9
	EPAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	13.5	.0	.0	50.9
	TA	52.9	.0	.0	.0	.0	.0	.0	.0	.0	11.7	.0	.0	64.6
	BA	26.7	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	33.3
9-11.9	CFA	752.0	.0	.0	.0	.0	.0	.0	.0	.0	137.9	.0	.0	889.8
	BFA	3204.2	.0	.0	.0	.0	.0	.0	.0	.0	450.2	.0	.0	3654.4
	APAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	EPAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	TA	13.6	15.5	.0	.0	.0	.0	.0	.0	.0	37.0	.0	.0	61.8
	BA	13.3	20.0	.0	.0	.0	.0	.0	.0	.0	40.0	.0	.0	66.7
12 +	CFA	416.4	643.0	.0	.0	.0	.0	.0	.0	.0	1126.0	.0	.0	1962.3
	BFA	2088.7	3300.5	.0	.0	.0	.0	.0	.0	.0	5495.6	.0	.0	9722.5
	APAI	5.5	.0	.0	.0	.0	.0	.0	.0	.0	9.8	.0	.0	15.3
	EPAI	5.5	6.2	.0	.0	.0	.0	.0	.0	.0	16.1	.0	.0	26.5
	TA	1279.9	15.5	.0	.0	.0	.0	.0	.0	.0	185.7	100.0	.0	1576.9
	BA	111.3	20.0	.0	.0	.0	.0	.0	.0	.0	65.2	.0	.0	189.9
TOTALS	CFA	2150.5	643.0	.0	.0	.0	.0	.0	.0	.0	1637.8	.0	.0	4208.2
	BFA	8718.6	3300.5	.0	.0	.0	.0	.0	.0	.0	7207.2	.0	.0	18064.1
	APAI	55.3	.0	.0	.0	.0	.0	.0	.0	.0	16.2	.0	.0	71.4
	EPAI	55.3	6.2	.0	.0	.0	.0	.0	.0	.0	29.6	.0	.0	89.7
						PERCENT STANDARD ERROR								
	TA	18.5	19.0	.0	.0	.0	.0	.0	.0	.0	57.3	100.0	.0	7.6
	BA	7.3	.0	.0	.0	.0	.0	.0	.0	.0	25.0	100.0	.0	1.9
TOTALS	CFA	22.8	3.5	.0	.0	.0	.0	.0	.0	.0	13.9	.0	.0	11.0
	BFA	24.5	5.0	.0	.0	.0	.0	.0	.0	.0	13.9	.0	.0	12.2

BARK BEETLE SURVEY
--LODGEPOLE PINE--

4/11/85

LOLO 406 02 123 201

DIAMETER CLASS		UNDAM. STAND	CUR. ATTACK	LAST YEAR'S ATTACK	OLDER ATTACK	UNSUC. ATTACK	CUR. STRIP ATTACK	OLDER STRIP ATTACK	CUR. SEC. ATTACK	OLDER SEC. ATTACK	OTHER I+D PROB.	OTHER DAM. AGENTS	OTHER MORT.	STAND TOTAL
0- 2.9	TA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	BA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3- 4.9	TA	200.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	200.0
	BA	18.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	18.3
5- 6.9	TA	128.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	128.2
	BA	26.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	26.7
	CFA	561.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	561.1
7- 8.9	TA	40.0	.0	.0	.0	.0	.0	.0	.0	.0	16.9	.0	.0	57.0
	BA	13.3	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	20.0
	CFA	368.9	.0	.0	.0	.0	.0	.0	.0	.0	242.4	.0	.0	611.4
9-10.9	TA	29.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29.2
	BA	13.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.3
	CFA	388.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	388.9
11-12.9	TA	17.1	.0	.0	.0	.0	.0	.0	.0	.0	16.0	.0	.0	33.1
	BA	13.3	.0	.0	.0	.0	.0	.0	.0	.0	13.3	.0	.0	26.7
	CFA	407.7	.0	.0	.0	.0	.0	.0	.0	.0	395.1	.0	.0	802.7
13-14.9	TA	5.7	7.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.9
	BA	6.7	6.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.3
	CFA	211.1	199.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	410.4
15-16.9	TA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	BA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	CFA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
17-18.9	TA	.0	8.4	.0	.0	.0	.0	.0	.0	.0	4.2	.0	.0	8.4
	BA	.0	13.3	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	13.3
	CFA	.0	443.7	.0	.0	.0	.0	.0	.0	.0	223.2	.0	.0	443.7
19 +	TA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	BA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	CFA	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0

APPENDIX 1, Con.

DEFOLIATOR SURVEY
--SPECIES TOTAL--

4/11/85

LOLO 406 02 123 201

DIAMETER CLASS		UNDAM. STAND	LIGHT DEF.	MOD. DEF.	HEAVY DEF.	LIGHT TOP KILL	MOD. TOP KILL	HEAVY TOP KILL	DEF. MORT.	OTHER I+D PROB.	OTHER MORT.	OTHER DAM. AGENTS	STAND TOTAL
0- 4.9	TA	1000.0	.0	.0	.0	.0	.0	.0	.0	1C0.0	100.0	.0	1200.0
	BA	24.6	.0	.0	.0	.0	.0	.0	.0	5.2	.0	.0	29.9
5- 8.9	TA	213.4	20.1	.0	.0	.0	.0	.0	.0	16.9	.0	.0	250.4
	BA	46.7	6.7	.0	.0	.0	.0	.0	.0	6.7	.0	.0	60.0
	CFA	982.1	131.5	.0	.0	.0	.0	.0	.0	242.4	.0	.0	1356.1
	BFA	3425.7	202.1	.0	.0	.0	.0	.0	.0	1059.3	.0	.0	4687.1
	APAI	37.5	.0	.0	.0	.0	.0	.0	.0	6.4	.0	.0	43.9
	EPAI	37.5	7.1	.0	.0	.0	.0	.0	.0	6.4	.0	.0	50.9
9-11.9	TA	52.9	11.7	.0	.0	.0	.0	.0	.0	11.7	.0	.0	64.6
	BA	26.7	6.7	.0	.0	.0	.0	.0	.0	6.7	.0	.0	33.3
	CFA	752.0	137.9	.0	.0	.0	.0	.0	.0	137.9	.0	.0	889.8
	BFA	3204.2	450.2	.0	.0	.0	.0	.0	.0	450.2	.0	.0	3654.4
	APAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	EPAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
12 +	TA	13.6	.0	8.3	4.7	3.7	.0	.0	.0	35.3	.0	.0	61.8
	BA	13.3	.0	6.7	6.7	6.7	.0	.0	.0	40.0	.0	.0	66.7
	CFA	416.4	.0	138.5	180.4	188.7	.0	.0	.0	1226.8	.0	.0	1962.3
	BFA	2088.7	.0	548.6	887.3	959.9	.0	.0	.0	6197.8	.0	.0	9722.5
	APAI	5.5	.0	.0	3.9	.0	.0	.0	.0	5.9	.0	.0	15.3
	EPAI	5.5	.0	2.6	4.5	1.8	.0	.0	.0	13.9	.0	.0	26.5
TOTALS	TA	1279.9	31.8	8.3	4.7	3.7	.0	.0	.0	163.9	100.0	.0	1576.9
	BA	111.3	13.3	6.7	6.7	6.7	.0	.0	.0	58.6	.0	.0	189.9
	CFA	2150.5	269.4	138.5	180.4	188.7	.0	.0	.0	1607.1	.0	.0	4208.2
	BFA	8718.6	652.4	548.6	887.3	959.9	.0	.0	.0	7707.3	.0	.0	18064.1
	APAI	55.3	.0	.0	3.9	.0	.0	.0	.0	12.3	.0	.0	71.4
	EPAI	55.3	7.1	2.6	4.5	1.8	.0	.0	.0	20.3	.0	.0	89.7
						PERCENT STANDARD ERROR							
TOTALS	TA	18.5	54.9	100.0	100.0	100.0	.0	.0	.0	63.9	100.0	.0	7.6
	BA	7.3	50.0	100.0	100.0	100.0	.0	.0	.0	17.6	100.0	.0	1.9
	CFA	22.8	50.0	100.0	100.0	100.0	.0	.0	.0	9.6	.0	.0	11.0
	BFA	24.5	59.9	100.0	100.0	100.0	.0	.0	.0	12.5	.0	.0	12.2

APPENDIX 1, Con.

DISEASE SURVEY
SPECIES TOTAL

4/11/85

LOLO 406 02 123 201

DIAMETER CLASS		UNDAM. STAND	MIS. INF.	MIS. MORT.	ROOT ROT INF.	CUR. ROOT ROT MORT.	OLDER ROOT ROT MORT.	BRANCH CANKER	STEM CANKER	STEM RUST MORT.	LIGHT NEEDLE DIS.	MOD. NEEDLE DIS.	HEAVY NEEDLE DIS.	BUTT, STEM DECAY	OTHER I+D PROB.	OTHER DAM. AGENTS	OTHER MORT.	STANI TOTAL
	TA	1000.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	100.0	100.0	.0	1200.0
0- 4.9	BA	24.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.2	.0	.0	29.9
	TA	213.4	16.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	37.0	.0	.0	250.4
	BA	46.7	6.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.3	.0	.0	60.0
5- 8.9	CFA	982.1	242.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	374.0	.0	.0	1356.1
	BFA	3425.7	1059.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	1261.4	.0	.0	4687.1
	APAI	37.5	6.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.4	.0	.0	43.9
	EPAI	37.5	6.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	13.5	.0	.0	50.9
	TA	52.9	.0	.0	11.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.7	.0	.0	64.6
	BA	26.7	.0	.0	6.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	33.3
9-11.9	CFA	752.0	.0	.0	137.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	137.9	.0	.0	889.8
	BFA	3204.2	.0	.0	450.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	450.2	.0	.0	3654.4
	APAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	EPAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	TA	13.6	11.9	.0	3.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	40.6	.0	.0	61.8
	BA	13.3	13.3	.0	6.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	46.7	.0	.0	66.7
12 +	CFA	416.4	433.9	.0	188.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	1335.1	.0	.0	1962.3
	BFA	2088.7	2207.4	.0	959.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	6588.6	.0	.0	9722.5
	APAI	5.5	3.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.9	.0	.0	15.3
	EPAI	5.5	5.3	.0	1.8	.0	.0	.0	.0	.0	.0	.0	.0	.0	17.1	.0	.0	26.5
	TA	1279.9	28.8	.0	15.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	189.3	100.0	.0	1576.9
	BA	111.3	20.0	.0	13.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	71.9	.0	.0	189.9
TOTALS	CFA	2150.5	676.3	.0	326.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	1846.9	.0	.0	4208.2
	BFA	8718.6	3266.7	.0	1410.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	8300.3	.0	.0	18064.1
	APAI	55.3	10.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.2	.0	.0	71.4
	EPAI	55.3	11.7	.0	1.8	.0	.0	.0	.0	.0	.0	.0	.0	.0	30.5	.0	.0	89.7
							PERCENT STANDARD ERROR											
	TA	18.5	39.6	.0	67.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	55.1	100.0	.0	7.6
	BA	7.3	.0	.0	50.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	16.6	100.0	.0	1.9
TOTALS	CFA	22.8	4.1	.0	51.8	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	11.0
	BFA	24.5	3.4	.0	59.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	8.4	.0	.0	12.2

APPENDIX 1, Con.

OTHER INSECT AND DAMAGING PROBLEM SURVEY
----------SPECIES TOTAL----------

4/11/85

LOLO 406 02 123 201

DIAMETER CLASS		UNDAM. STAND	SHOOT INSECT	STEM BORER	GALL INSECT	SCALES, APHID	WEB-WORMS	LIGHT WIN. DAM.	MOD. WIN. DAM.	HEAVY WIN. DAM.	ANIMAL DAM.	SPIKE TOPS	OTHER I+D PROB.	OTHER DAM. AGENTS	OTHER MORT.	STAND TOTAL
	TA	1000.0	.0	100.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	100.0	.0	1200.0
0- 4.9	BA	24.6	.0	5.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	29.9
	TA	213.4	.0	.0	.0	.0	.0	.0	.0	.0	.0	16.9	37.0	.0	.0	250.4
	BA	46.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.7	13.3	.0	.0	60.0
5- 8.9	CFA	982.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	242.4	374.0	.0	.0	1356.1
	BFA	3425.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	1059.3	1261.4	.0	.0	4687.1
	APAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.4	6.4	.0	.0	43.9
	EPAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.4	13.5	.0	.0	50.9
	TA	52.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.7	.0	.0	64.6
	BA	26.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	33.3
9-11.9	CFA	752.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	137.9	.0	.0	889.8
	BFA	3204.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	450.2	.0	.0	3654.4
	APAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	EPAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	12.3
	TA	13.6	.0	.0	.0	.0	.0	.0	.0	.0	8.3	.0	39.9	.0	.0	61.8
	BA	13.3	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	46.7	.0	.0	66.7
12 +	CFA	416.4	.0	.0	.0	.0	.0	.0	.0	.0	184.4	.0	1361.5	.0	.0	1962.3
	BFA	2088.7	.0	.0	.0	.0	.0	.0	.0	.0	892.3	.0	6741.5	.0	.0	9722.5
	APAI	5.5	.0	.0	.0	.0	.0	.0	.0	.0	2.0	.0	7.8	.0	.0	15.3
	EPAI	5.5	.0	.0	.0	.0	.0	.0	.0	.0	2.0	.0	19.0	.0	.0	26.5
	TA	1279.9	.0	100.0	.0	.0	.0	.0	.0	.0	8.3	16.9	88.7	100.0	.0	1576.9
	BA	111.3	.0	5.2	.0	.0	.0	.0	.0	.0	6.7	6.7	66.7	.0	.0	189.9
TOTALS	CFA	2150.5	.0	.0	.0	.0	.0	.0	.0	.0	184.4	242.4	1873.3	.0	.0	4208.2
	BFA	8718.6	.0	.0	.0	.0	.0	.0	.0	.0	892.3	1059.3	8453.2	.0	.0	18064.1
	APAI	55.3	.0	.0	.0	.0	.0	.0	.0	.0	2.0	6.4	14.2	.0	.0	71.4
	EPAI	55.3	.0	.0	.0	.0	.0	.0	.0	.0	2.0	6.4	32.5	.0	.0	89.7
							PERCENT STANDARD ERROR									
	TA	18.5	.0	100.0	.0	.0	.0	.0	.0	.0	100.0	100.0	11.3	100.0	.0	7.6
	BA	7.3	.0	100.0	.0	.0	.0	.0	.0	.0	100.0	100.0	10.0	100.0	.0	1.9
TOTALS	CFA	22.8	.0	.0	.0	.0	.0	.0	.0	.0	100.0	100.0	11.6	.0	.0	11.0
	BFA	24.5	.0	.0	.0	.0	.0	.0	.0	.0	100.0	100.0	12.4	.0	.0	12.2

APPENDIX 1, Con.

DISEASE ASSOCIATES
SPECIES TOTAL

4/11/85

LOLO 406 02 123 201

DIAMETER		UNDAM. STAND	A. MELLEA CURRENT	A. MELLEA BEETLE	P. WEIRII	P. WEIRII BEETLES	P. SCHWE.	P. SCHWE. BEETLES	V. WAGEN.	V. WAGEN. BEETLES	F. ANNOS.	F. ANNOS. BEETLES	OTHER DISEASES	OTHER SPECIES	OTHER IED BEETLE	OTHER PROB.	OTHER DAM. AGENTS	OTHER MORT.	STD TOTAL
	TA	1000.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	200.0		100.0	.0	1200.0
0- 4.9	BA	24.6	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	5.2		.0	.0	29.9
	TA	213.4	.0	.0	.0	.0	.0	.0	.0	.0	20.1	.0	.0	.0	37.0		.0	.0	250.4
	BA	46.7	.0	.0	.0	.0	.0	.0	.0	.0	6.7	.0	.0	.0	13.3		.0	.0	60.0
5- 8.9	CFA	982.1	.0	.0	.0	.0	.0	.0	.0	.0	131.5	.0	.0	.0	374.0		.0	.0	1356.1
	BFA	3425.7	.0	.0	.0	.0	.0	.0	.0	.0	202.1	.0	.0	.0	1261.4		.0	.0	4687.1
	APAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.4		.0	.0	43.9
	EPAI	37.5	.0	.0	.0	.0	.0	.0	.0	.0	7.1	.0	.0	.0	13.5		.0	.0	50.9
	TA	52.9	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	11.7		.0	.0	64.6
	BA	26.7	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	6.7		.0	.0	33.3
9-11.9	CFA	752.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	137.9		.0	.0	889.8
	BFA	3204.2	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	450.2		.0	.0	3654.4
	APAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0		.0	.0	12.3
	EPAI	12.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0		.0	.0	12.3
	TA	13.6	.0	.0	.0	.0	3.7	.0	.0	.0	8.3	.0	.0	.0	48.3		.0	.0	61.8
	BA	13.3	.0	.0	.0	.0	6.7	.0	.0	.0	6.7	.0	.0	.0	53.3		.0	.0	66.7
12 +	CFA	416.4	.0	.0	.0	.0	188.7	.0	.0	.0	138.5	.0	.0	.0	1545.8		.0	.0	1962.3
	BFA	2088.7	.0	.0	.0	.0	959.9	.0	.0	.0	548.6	.0	.0	.0	7633.8		.0	.0	9722.5
	APAI	5.5	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	9.8		.0	.0	15.3
	EPAI	5.5	.0	.0	.0	.0	1.8	.0	.0	.0	2.6	.0	.0	.0	21.0		.0	.0	26.5
	TA	1279.9	.0	.0	.0	.0	3.7	.0	.0	.0	28.4	.0	.0	.0	297.0		100.0	.0	1576.9
	BA	111.3	.0	.0	.0	.0	6.7	.0	.0	.0	13.3	.0	.0	.0	78.6		.0	.0	189.9
TOTALS	CFA	2150.5	.0	.0	.0	.0	188.7	.0	.0	.0	270.1	.0	.0	.0	2057.6		.0	.0	4208.2
	BFA	8718.6	.0	.0	.0	.0	959.9	.0	.0	.0	750.8	.0	.0	.0	9345.5		.0	.0	18064.1
	APAI	55.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	16.2		.0	.0	71.4
	EPAI	55.3	.0	.0	.0	.0	1.8	.0	.0	.0	9.7	.0	.0	.0	34.4		.0	.0	89.7
							PERCENT STANDARD ERROR												
	TA	18.5	.0	.0	.0	.0	100.0	.0	.0	.0	61.5	.0	.0	.0	67.5		100.0	.0	7.6
	BA	7.3	.0	.0	.0	.0	100.0	.0	.0	.0	50.0	.0	.0	.0	13.2		100.0	.0	1.9
TOTALS	CFA	22.8	.0	.0	.0	.0	100.0	.0	.0	.0	50.1	.0	.0	.0	5.4		.0	.0	11.0
	BFA	24.5	.0	.0	.0	.0	100.0	.0	.0	.0	64.0	.0	.0	.0	4.0		.0	.0	12.2

Appendix 2. Example of a Data File.

```
201 1010          406 02 123      01                              3120003041185
201 01 720 DF  102  61      21  21  28 11 22
201 01 720 DF  121  62      30  30  47 12 68
201 01 720 LP  171  81      15  15  17  2 20 82
201 01 720 LP  121  65      21  21  31 48
201 01 720 LP   68                      0
201 01 720 LP   88                      0
201 01 720 DF   52  52      16  16  25  0
201 01 720 DF   31                     41
201 01 720 LP   49                      0
201 01 720 AF    1                     50
201 01 720 AF   11                      0
201 02 720 DF  181  86      21  21  37 14 22 64
201 02 720 LP   68                      0
201 02 720 LP  171  80      28  28  31  2
201 02 720 LP  126  75      45  45  48 20 83
201 02 720 LP   92                      0
201 02 720 LP  146                      0
201 02 720 DF   78  58      62  62  69 11 68
201 02 720 LP   31                      0
201 02 720 LP   91                      0
201 02 720 AF    1                      0
201 02 720 AF   21                      0
201 02 720 DF   12                      0
201 02 720 AF    1                      0
201 03 720 DF   92  71      19  19  22  0
201 03 720 LP   85  81      45  45  47 49 20 82
201 03 720 DF  162  82      62  62  68 13
201 03 720 LP  131  71      31  31  34  2 84
201 03 720 LP  125                      0
201 03 720 AF    1                      0
201 03 720 LP   53                      0
201 03 720 LP   71                      0
201 03 720 DF   21                      0
201 03 720 DF    1                      0
201 03 720 LP   62                      0
201 03 720 LP  115                      0
999
```

APPENDIX 3

DIAMETER OF THE TREE OF MEAN BASAL AREA BY DAMAGE CLASS 4/11/85

LOLO 406 02 123 201

SPECIES	UNDAM. STAND	CUR. ATTACK	LAST YEAR'S ATTACK	OLDER ATTACK	UNSUC. ATTACK	CUR. STRIP ATTACK	OLDER STRIP ATTACK	CUR. SEC. ATTACK	OLDER SEC. ATTACK	OTHER I+D PROB.	OTHER DAM. AGENTS	OTHER MORT.	STAND TOTAL
GF	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AF	1.1	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	1.0
J	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
L	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
WLP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
LP	6.3	15.4	.0	.0	.0	.0	.0	.0	.0	11.5	.0	.0	7.2
WP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
PP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
DF	2.9	.0	.0	.0	.0	.0	.0	.0	.0	6.9	.0	.0	4.5
Y	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
C	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
WH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
MH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
B	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ASH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
CW	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
ASP	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
OH	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
AL	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
TOTAL	4.0	15.4	.0	.0	.0	.0	.0	.0	.0	8.0	.1	.0	4.7

CROWN COMPETITION FACTOR = 211.2

COVARIANCE TEST FOR
GROWTH DIFFERENCES F= 4.26

APPENDIX 4

LOLO 406 02 123 201

HABITAT TYPE 721 AVERAGE LPP DBH 5+ 7.81
MOUNTAIN PINE BEETLE MODEL
FOR LODGEPOLE PINE

LODGEPOLE PINE TREES PER ACRE AND CUBIC FT. VOLUME
BEFORE AN OUTBREAK

	0-2.9	3-4.9	5-6.9	7-8.9	9-10.9	11-12.9	13-14.9	15-16.9	17-18.9	19+	TOTAL
T/A	.00	200.00	128.18	56.95	29.20	33.11	12.86	.00	8.36	.00	468.67
DEAD	.00	.00	.00	.00	.00	.00	7.12	.00	8.36	.00	15.48
MORT2	.00	.00	.49	.73	.60	1.17	7.12	.00	8.36	.00	18.47
CFA	.00	.00	561.14	611.37	388.88	802.74	410.37	.00	443.72	.00	3218.22

TREES PER ACRES LOSS DURING 10 YEAR OUTBREAK

	0-2.9		3-4.9		5-6.9		7-8.9		9-10.9		11-12.9		13-14.9		15-16.9		17-18.9		19+	
YEAR	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT	GT	MORT
1	.0	.00	200.0	.00	127.8	.41	56.2	.75	28.6	.62	29.6	3.49	.7	5.04	.0	.00	.0	.00	.0	.00
2	.0	.00	200.0	.00	127.4	.34	55.4	.76	28.0	.62	21.2	8.40	.2	.54	.0	.00	.0	.00	.0	.00
3	.0	.00	200.0	.00	127.2	.28	54.7	.76	27.3	.61	9.5	11.70	.1	.02	.0	.00	.0	.00	.0	.00
4	.0	.00	200.0	.00	126.9	.23	53.9	.75	26.8	.59	3.1	6.40	.1	.00	.0	.00	.0	.00	.0	.00
5	.0	.00	200.0	.00	126.7	.19	53.2	.73	26.2	.56	1.7	1.43	.1	.00	.0	.00	.0	.00	.0	.00
6	.0	.00	200.0	.00	126.6	.16	52.5	.70	25.7	.52	1.5	.22	.1	.00	.0	.00	.0	.00	.0	.00
7	.0	.00	200.0	.00	126.4	.13	51.8	.66	25.2	.47	1.4	.03	.1	.00	.0	.00	.0	.00	.0	.00
8	.0	.00	200.0	.00	126.3	.11	51.2	.62	24.8	.42	1.4	.00	.1	.00	.0	.00	.0	.00	.0	.00
9	.0	.00	200.0	.00	126.2	.09	50.6	.57	24.4	.37	1.4	.00	.1	.00	.0	.00	.0	.00	.0	.00
10	.0	.00	200.0	.00	126.2	.07	50.1	.53	24.1	.32	1.4	.00	.1	.00	.0	.00	.0	.00	.0	.00

LODGEPOLE PINE TREES PER ACRES AND CFV
AFTER AN OUTBREAK

	0-2.9	3-4.9	5-6.9	7-8.9	9-10.9	11-12.9	13-14.9	15-16.9	17-18.9	19+	TOTAL
T/A	.00	200.00	126.17	50.12	24.11	1.44	.13	.00	.00	.00	401.98
CFA	.00	.00	552.34	538.04	321.10	34.98	4.18	.00	.00	.00	1450.64